

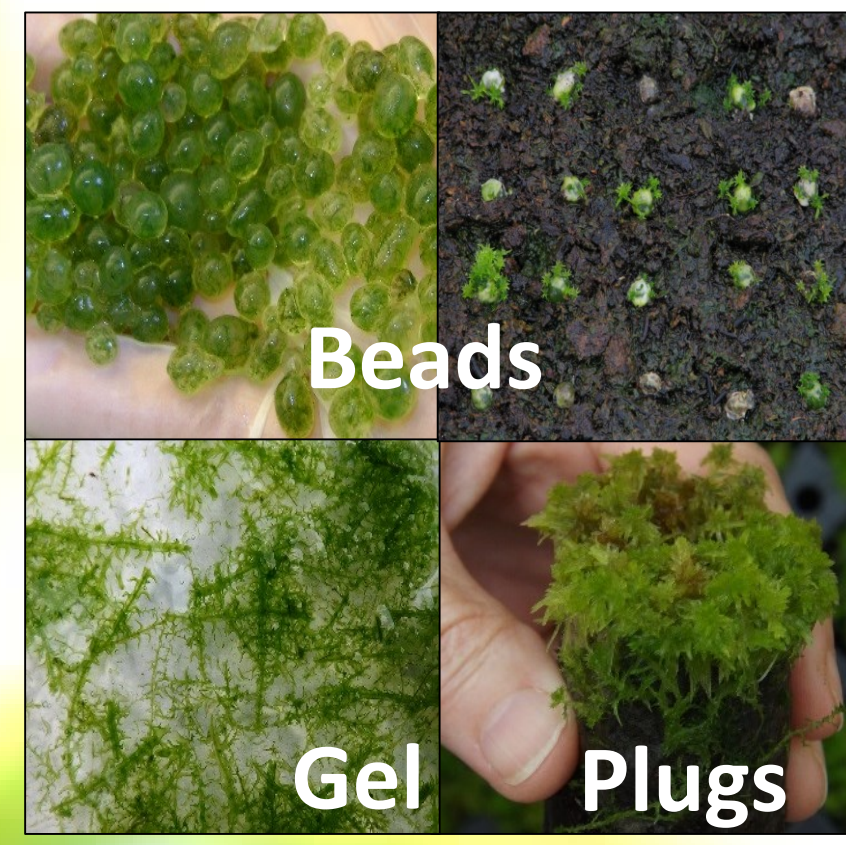
Sphagnum restoration using micropropagated Beads, Plugs and Gel: a review of experimental trials over 10 years

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There is increasing demand for a reliable *Sphagnum* supply for bog restoration in damaged landscapes and for *Sphagnum* farming. Usually, *Sphagnum* is translocated from donor to receptor sites and spread over large areas of bare or degraded peatland. However, this is often limited by a lack of local, donor *Sphagnum* and a range of other difficulties. To overcome these problems, we describe the propagation of *Sphagnum* from vegetative material in sterile tissue culture and the potentially unlimited production of juvenile plants in a variety of forms.

Field trials on degraded upland blanket bog and on a lowland cut-over peatland in northern England over 10 years explored the planting methods and potential of this new approach for *Sphagnum* production and restoration. Micropropagated *Sphagnum* was produced by Micropropagation Services (EM) Ltd. The apical capitula sections were grown under aseptic conditions using standard tissue culture methods. After around 20 weeks *Sphagnum* plants were moved to outdoor or greenhouse conditions in the form of either liquid Gel (BeadGel™), Plugs (BeadHumok™) or solid gel Beads (BeadMoss®).



Early *Sphagnum* Bead trials on degraded Southern Pennine blanket bogs in 2008 - planted into treated, re-vegetated peat surfaces or bare peat surfaces (below)

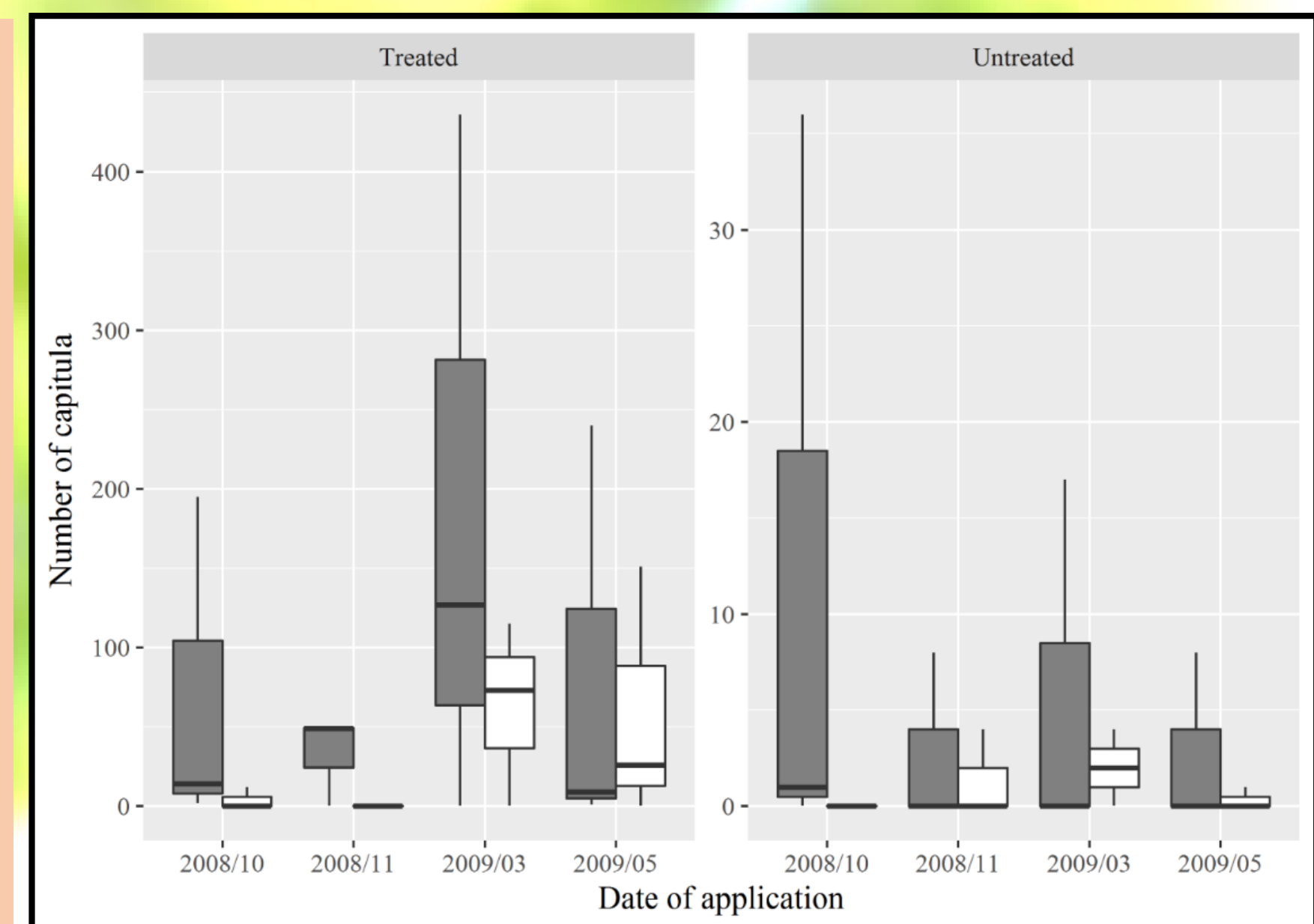


After six years, the *Sphagnum* beads showed much better growth on treated, vegetated surfaces than when planted on bare ground.

There was a small, consistent benefit of brush covering, but no overall significant effect of sowing month.

However, inter-plot variation was great, making it difficult to detect statistically significant patterns

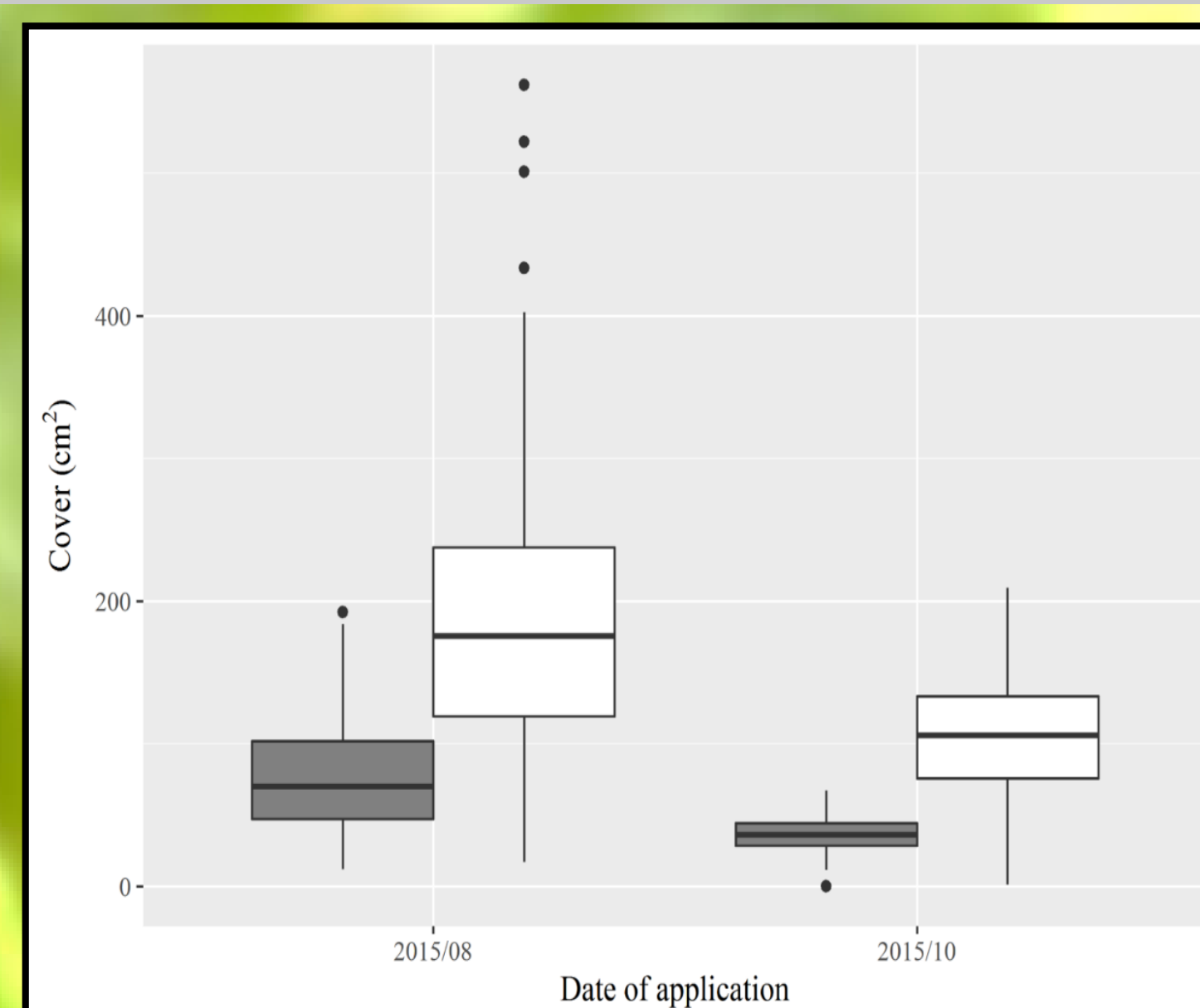
After 6 years, the planting of 100 beads produced over 400 *Sphagnum* capitula on the best plots in vegetated, brushed areas but only 36 on the bare peat, brushed areas (see Graph – right)



S. fallax capitula in June 2014 after application of beads in 2008 -2009 on treated or untreated peat surfaces. Some plots were covered with heather brush (grey) and others - not (white).

***Sphagnum* plugs introduction on blanket bogs** - the aim was to examine the growth of mixed-species *Sphagnum* Plugs in sedge/ grass-dominated vegetation and on adjacent bare peat on blanket bog (below).

An area of intact blanket bog peat (below), dominated by dense mature *Eriophorum* sedge, was planted with 36 *Sphagnum* plugs in each of four x 1 m² plots. Repeat planting occurred in August and October 2015.



Cover (cm²) of *Sphagnum* plugs planted into *E. angustifolium*-dominated blanket bog vegetation, in August and October 2015, and later monitored in June (grey) and November (white) 2016.

Almost all Plugs planted into dense *Eriophorum*-dominated vegetation survived (99.3% survival).

By June 2016, the plug area of those established in August 2015 was 64.7±29.1 cm², a mean growth of 635±286% of the original plug size. This was almost twice that of those planted two months later - suggesting a benefit of late summer planting.



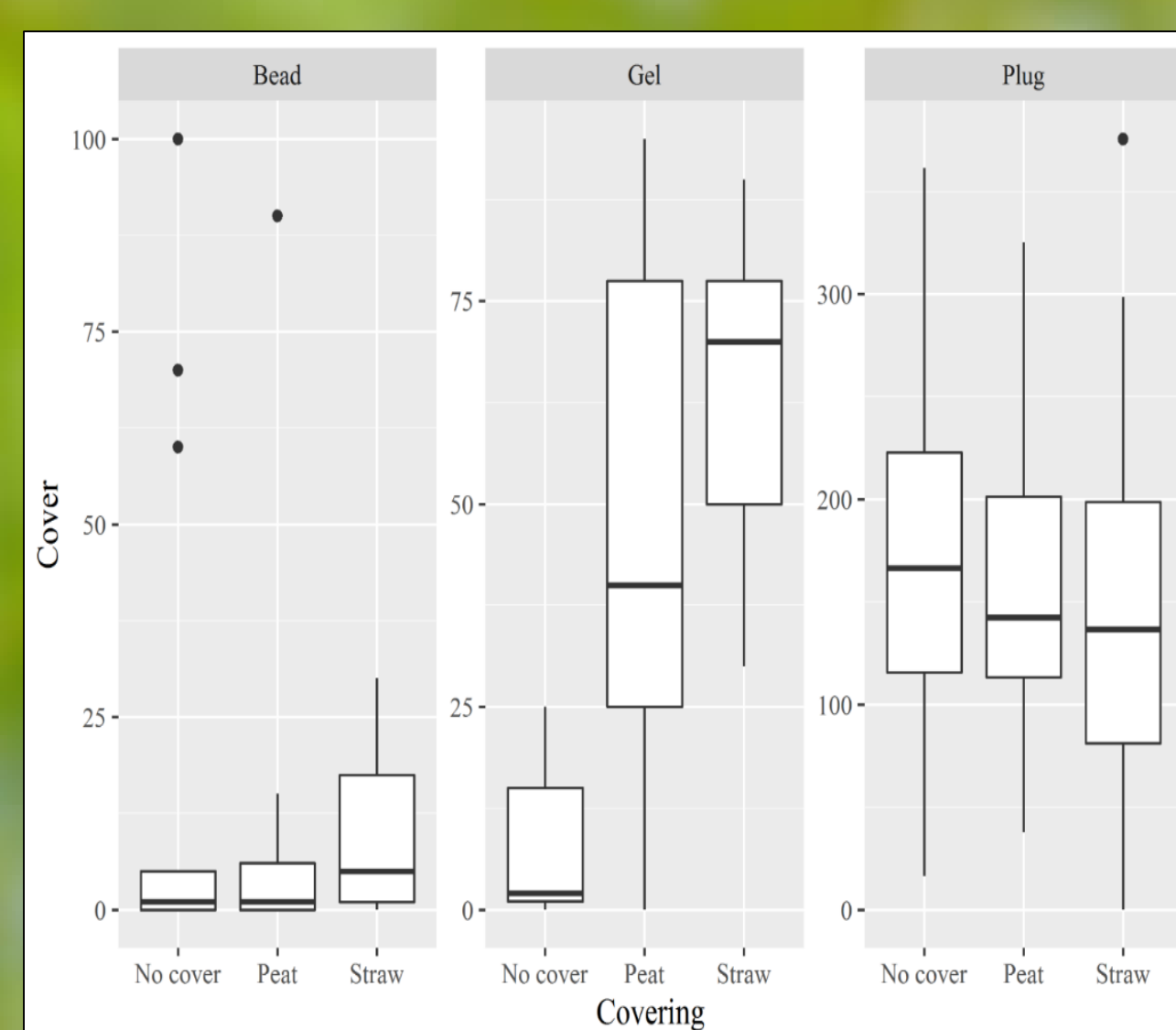
After two years, *Sphagnum* plugs were in very good condition, enjoying the protection of the cottongrass.

***Sphagnum* introduction to re-wetted lowland cut-over bogs for restoration and *Sphagnum* production** - started on Manchester Mosslands in 2014; planting of *Sphagnum* propagules – Beads, Gel and Plugs -was kept to areas of continuous cotton grass (*E. angustifolium*) cover.

Of the three types of micropropagated *Sphagnum*, plugs and gel were the most successful, able to establish and rapidly increase in cover. Bead establishment was slower, but may prove more cost-effective in the long term (see Graph - right)

Companion vegetation (*Eriophorum*) proved to be vital, while the benefits of other coverings, loose peat or straw were mixed, depending on the *Sphagnum* type.

Although lowland peatlands typically provide a less hostile climate, flooding, and bird and small mammal disturbance were found to be more likely constraints here than in the uplands.



Sphagnum cover (% and cm², respectively) 18 months following application of *Sphagnum* beads (left), gel (centre) and plugs (right, initial plug size was 10.2 cm²) in December 2014.



Three forms of *Sphagnum* on lowland restoration site planted in 2014 in open *E. angustifolium*. Photos May-June 2016



Current *Sphagnum* production trials using Plugs in mid Wales with Natural Resources Wales.

Conclusions: Ten years of trials on upland and lowland peatlands explored the potential of this new approach for *Sphagnum* production. *Sphagnum* plugs proved the most reliable for generating quick cover but these are more expensive in terms of labour and material cost. The Beads and Gel were more cost effective, but require careful site selection with high water table and companion plant protection.

